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# Five-Year Review Report

## Third Five-Year Review Report

For

**Brown's Battery Breaking Superfund Site**

**Tilden Township**

**Berks County, Pennsylvania**

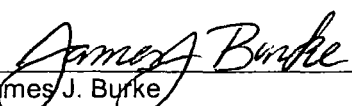
**September 2007**

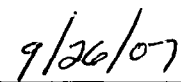
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# Five-Year Review Report

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## **List of Acronyms**

ARAR	Applicable or Relevant and Appropriate Requirement
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of Concern
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Difference
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
NCP	National Contingency Plan (the "National Oil and Hazardous Substances Pollution Contingency Plan")
NPL	National Priorities List
OU	Operable Unit
O&M	Operation and Maintenance
PRP	Potentially Responsible Party
RA	Remedial Action
RAO	Remedial Action Objective
RCRA	Resource, Conservation and Recovery Act
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SDWA	Safe Drinking Water Act

## **Executive Summary**

The trigger for this five-year review was the previous five-year review report signed on September 24, 2002.

The assessment of this five-year review found that the remedy was constructed in accordance with the requirements of the Record of Decision (ROD; 1992). The ROD was followed by three Explanations of Significant Differences (ESDs) and two ROD amendments which modified the initial remedy. The 1992 ROD required excavation and onsite treatment of soil exceeding 1000 ppm lead; off-site disposal of approximately 67,000 cubic yards of soil and battery casings; installation of a vertical limestone barrier to act as an in-situ treatment trench in the shallow alluvial aquifer and pumping and onsite treatment of groundwater from the deeper bedrock aquifer. The ROD was followed by several changes to the initial remedy. Explanations of Significant Differences (ESDs) were issued in 1996, 1997, and 2003. In addition, two ROD Amendments were issued: one in 2000 and the other in 2003. These changes are detailed further in Section IV of this Five Year Review Report.

The remedy is functioning as designed and is expected to be fully protective when groundwater cleanup goals are achieved throughout the plume.

The remedy is considered protective of human health and the environment in the short term. Site groundwater contamination is being treated chemically in-situ. No domestic wells are impacted by site contamination.

Long-term protectiveness of the remedy is expected to be achieved through the continued operation of the in-situ chemical treatment and the implementation of institutional controls for a portion of the site. Sampling and monitoring of ground water is expected to continue until cleanup goals are met.

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## Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name (from Waste LAN): <b>Brown's Battery Superfund Site</b>		
EPA ID (from WasteLAN): <b>PAD980831812</b>		
Region: <b>3</b>	State: <b>PA</b>	City/County: <b>Berks County</b>
SITE STATUS		
NPL status: <input checked="" type="checkbox"/> Final <input type="checkbox"/> Deleted <input type="checkbox"/> Other (specify) _____		
Remediation status (choose all that apply): <input type="checkbox"/> Under Construction <input type="checkbox"/> Operating <input checked="" type="checkbox"/> Complete		
Multiple OUs? <b>Yes</b>	Construction completion date: <b>11/03/2003</b>	
Has site been put into reuse? <b>NO</b>		
REVIEW STATUS		
Lead agency: <input checked="" type="checkbox"/> EPA <input type="checkbox"/> State <input type="checkbox"/> Tribe <input type="checkbox"/> Other Federal Agency _____		
Author name: <b>Romuald A. Roman</b>		
Author title: <b>Remedial Project Manager</b>	Author affiliation: <b>U.S. EPA Reg. 3, HSCD</b>	
Review period:** <b>9/31/2002 to 9/30/2007</b>		
Date(s) of site inspection: <b>May 23, 2007</b>		
Type of review: <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div> <input checked="" type="checkbox"/> Post-SARA  <input type="checkbox"/> Non-NPL Remedial Action Site  <input type="checkbox"/> Regional Discretion               </div> <div> <input type="checkbox"/> Pre-SARA  <input type="checkbox"/> NPL State/Tribe-lead               </div> <div> <input type="checkbox"/> NPL-Removal only               </div> </div>		
Review number: <input type="checkbox"/> 1 (first) <input type="checkbox"/> 2 (second) <input checked="" type="checkbox"/> 3 (third) <input type="checkbox"/> Other (specify) _____		
Triggering action: <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div> <input type="checkbox"/> Actual RA Onsite Construction at OU # _____  <input type="checkbox"/> Construction Completion  <input type="checkbox"/> Other (specify) _____               </div> <div> <input type="checkbox"/> Actual RA Start at OU# <u>  1  </u>  <input checked="" type="checkbox"/> Previous Five-Year Review Report               </div> </div>		
Triggering action date (from WasteLAN): <b>9/24/2002</b>		
Due date (five years after triggering action date): <b>9/24/2007</b>		

\* ["OU" refers to operable unit.]

\*\* [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

**Issues:**

1. Verify historical conditions by monitoring "log house" well and "shop well."
2. Increase effectiveness of in-situ injections.
3. Implement institutional controls for the railroad embankment portion of the site.

**Recommendations and Follow-up Actions:**

1. Add two wells to long term monitoring program ("log house " and "shop well").
2. Evaluate changing the alkalinity agent.
3. Implement institutional controls for the railroad embankment portion of the site.

**Protectiveness Statement(s):**

The remedy is considered protective of human health and the environment in the short term. Site groundwater contamination is being treated chemically in-situ. No domestic wells are impacted by site contamination. Long-term protectiveness of the remedy is expected to be achieved through the continued operation of the in-situ chemical treatment and implementation of institutional controls for one portion of the site. Sampling and monitoring of ground water is expected to continue until cleanup goals are met.

**Other Comments:**

N/A

## **I. Introduction**

The purpose of the five-year review is to determine whether the remedy at a Site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, five-year review reports identify issues found during the review, if any, and recommendations to address them.

The United States Environmental Protection Agency (EPA) is preparing this five-year review report pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) § 121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121states:

*If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The Agency interpreted this requirement further in the NCP; 40 Code of Federal Regulations §300.430(f)(4)(ii) states:

*If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

The United States Environmental Protection Agency Region 3 has conducted a five-year review of the remedial actions implemented at the Browns Battery Breaking Superfund Site in Tilden Township, PA. This review was conducted from 3/31/2007 through September 2007. This report documents the results of the review.

This is the third five-year review for the Browns Battery Breaking Site. The triggering action for this review is the date of the last five-year review, as shown in EPA's WasteLAN database: September 24, 2002. The five-year reviews at this Site were specifically activated because hazardous substances, pollutants, or contaminants currently remain on-site above levels that allow for unlimited use and unrestricted exposure.

## **II. Site Chronology**

The table below summarizes important events and relevant dates in the chronology of the Brown's Battery Breaking Site.

**Table 1: Chronology of Site Events**

Date	Event
1983	EPA conducted a Preliminary Assessment and Extent of Contamination Survey.
1983	EPA Removal Action temporarily relocated three families.
1984	EPA performed Removal Action to consolidate and cap contaminated soil and battery casings.
1984	Site proposed for the NPL.
1986	Site listed on the NPL.
1990	EPA signed Operable Unit ("OU") 1 Record of Decision ("ROD") to permanently relocate residents.
1991	EPA completed Remedial Investigation and Feasibility Study ("RI/FS").
1992	EPA signed the OU-2 ROD to excavate, treat and dispose contaminated soil and battery casings and remediate ground water.
1995	EPA and Federal Trustees signed a Consent Decree with four Responsible Parties.
1996	Responsible Party (the RP), Exide Inc., started the Remedial Design.
1996	EPA issued ESD No.1 selecting alternate off-site locations for treatment prior to off-site disposal.
1997	EPA issued ESD No. 2 modifying ground water cleanup to MCLs.
1997	EPA issued First Five year Review.
2000	EPA amended the RODs eliminating the demolition of residence, limiting the separation of lead posts and plates, and allowing backfilling of soil containing less than 1000 ppm of lead.
2000	The RP completed the Remedial Design, mobilized to the Site and began the Remedial Action.
2001	The RP excavated, treated, and staged 25,000 tons of soil and battery casings.
2002 April	The RP filed for Chapter 11 bankruptcy protection.
2002 June	EPA began Removal Action to complete soil cleanup.

2002	EPA issued Second Five Year Review.	
2003 July	EPA issued the second ROD Amendment which replaced the barrier and pump-and-treat technology with the injection of in-situ treatment agent(s) into the contaminated bedrock.	
2003 September	EPA issued the third ESD which required adding a two-foot soil cover to be placed on the railroad embankment, and extended site use restrictions to include the railroad embankment.	
2003	EPA completed the soil cleanup in August 2003, stabilizing and disposing 43,000 tons of soil and battery casings.	
2003 till present	The RP graded and re-vegetated the Site and began chemical in-situ cleanup of the groundwater.	

### III. Background

#### Physical Characteristics

The Erown's Battery Breaking Site (the Site) is located in a predominantly agricultural part of Berks County in Tilden Township approximately 2.5 miles southwest of Hamburg, Pennsylvania. The nearest village is Shoemakersville. The Site is surrounded on three sides by the Schuylkill River, Mill Creek, and a fenced railroad tracks (Figure 1). It is accessible only from the north where it borders Fisher Dam Road. The 15-acre Site is currently relatively flat. Prior to the removal action, there was a pile of battery castings in the southwest corner of the Site, known as the "containment area." There are several buildings at the Site (Photo 1).

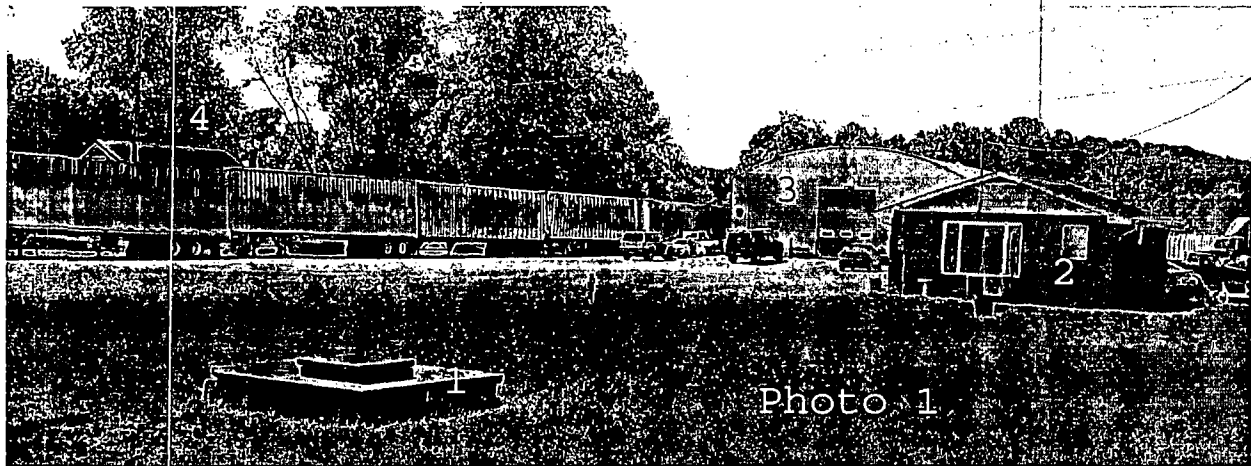


Photo 1 shows the location of well (1) used by brick office building (2), used by the automobile and truck service shop (3), and the roof of an inhabited "log house" (4).

There is a one-story brick structure (2), an automobile and truck service shop (3), surrounded by old trailers, on a central meadow (also known as Containment Area) on the Site. There is also an inhabited "log house" (4) on an adjacent parcel. It had been initially considered to be a part of the Site, but once cleaned up to residential standards, it was left intact.

### Land and Resource Use

Currently, the owner of the truck service shop uses the building as a truck body shop, "Rt. 61 Autobody."

The residences in a nearby community are located outside the contaminant migration routes from the Site. There is one well located on the Site and one well located on an adjacent parcel. The first one, visible on Photo 1, (1), provides water to the brick building and the truck body shop. According to the owner, water from this well is used solely to flush a toilet in his shop. The second well, visible on Photo 2 is believed to be used as a drinking water source by the "log house" residents. Both wells were sampled during the RI, and were clean. The well associated with the brick structure (Photo 1) was sampled as part of this 5 Year Review, and does not contain contamination from the Site. Access was not given to sample the "log house" well (Photo 2) to verify historical conditions.

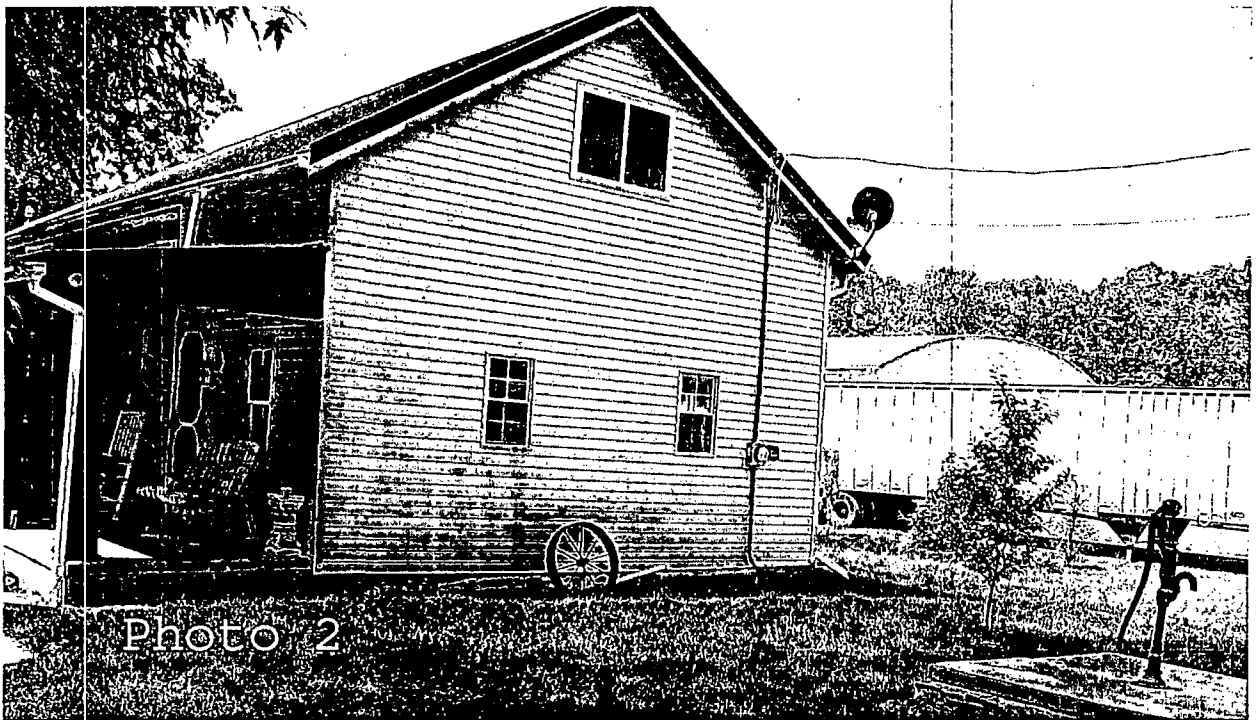


Photo 2 shows the side of the "log house" residence and the hand dug well utilized for drinking water.

Except for one parcel of the site, institutional controls in the form of easements have been placed on the Site property eliminating the potential for residential use. Industrial use of the northern portion of the Site is acceptable. Residential and industrial use is prohibited in the

southernmost portion of the Site which is governed by the Conservation Easement. There are no deed restrictions on the adjacent property associated with the "log house" of the Site.

## **History of Contamination**

A battery recycling and lead recovery process operated at the Site from 1961 to 1971. A hydraulic guillotine opened the batteries, and their lead alloy grids were extracted for recycling. The sulfuric acid, containing dissolved lead and cadmium, was poured onto the ground and the battery casings were deposited in nearby pits or on the surface adjacent to the battery breaking building. Beginning in 1965, the battery casings were rinsed with water to collect insoluble lead and the casings were crushed before being deposited throughout the Site or used in nearby areas as a substitute for fill or road and driveway gravel. At the Site they were spread from Fisher Dam Road to the service shop, sometimes placed in pits as deep as 10 feet below the surface of the ground. Residents in nearby villages used pieces of broken casings to pave their driveways. The total number of disposed batteries is unknown. Operations at the Site ceased in 1971 when Robert Brown, the owner and operator, died.

In 1980, tests on the cattle and pondwater in the farm where broken battery casings were used as the driveway materials revealed high levels of lead. The farmer identified a nearby property on Fisher Dam Road, formerly owned by Mr. Brown, as the supplier of the battery casings. This property later became known as the Brown's Battery Breaking Superfund Site.

## **Basis for Taking Action**

During the ten years of facility operations, tons of lead sulfates, lead oxides, particles of lead alloy, and substantial amounts of sulfuric acid entered soil, groundwater, and eventually surface water and sediment. People living at the Site at that time were exposed to heavy metals in air, soil and water. In June 1983, the Pennsylvania Department of Health (DOH) tested the blood of the four children who lived on the Site. Their blood tests revealed lead concentrations in excess of the health action limit.

Further sampling during a remedial investigation ("RI") phase revealed lead and other heavy metals in soils, sediments, surface water in Mill Creek and the Schuylkill River, and in groundwater at the Site. The vertical distribution of lead at concentrations greater than 1000 ppm was generally limited to the upper four feet of soil. The most highly contaminated soils were between the containment area and the service shop, in the area just southwest of the mobile home residence adjacent to the Schuylkill River, and in the wooded area between the containment area and Schuylkill River. Concentrations of lead in soil ranged from background to 60,000 ppm.

Ground water sampling results indicated that lead and zinc from broken batteries became mobilized in ground water due to battery acid dumping which has depressed ground water pH.

In addition, acid has mobilized also iron, manganese, nickel, aluminum, and cobalt which occur naturally onsite.

EPA performed a baseline risk assessment ("RA") to evaluate the health and environmental impacts from exposure to the contaminated soil, battery wastes, and ground water as a drinking water source at Site. The assessment focused on the health effects that could result from the following exposure pathways:

- Ingestion of contaminated soil and settled house dust by a resident child and adult.
- Ingestion of contaminated fish caught in the Schuylkill River by a resident child or adult.
- Ingestion of contaminated water by a resident child swimming in the Schuylkill River.
- Ingestion of contaminated drinking water by a resident child or adult.
- Inhalation of contaminated respirable dust by a resident child or adult.

The ROD concluded the RA stating that "releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to the public health, welfare, or the environment."

## **IV. Remedial Actions**

### **Remedy Selection**

In September 1990 EPA signed the ROD ("1990 ROD") to permanently relocate residents, construct a fence around the Site, and place deed restrictions on the property.

In July 1992, EPA issued another ROD ("1992 ROD") to address contaminated soil and groundwater at the Site. The selected remedial action for OU-2 was the excavation and onsite treatment of soil exceeding 1,000 ppm (lead); off-site disposal of approximately 67,000 cubic yards of soil and battery casings; construction of vertical limestone barrier in the shallow aquifer to neutralize pH levels in groundwater; and onsite treatment of contaminated groundwater in the bedrock aquifer. EPA also selected a contingent remedy to stabilize the soil and battery casings onsite followed by disposal in an offsite landfill if the onsite treatment technology proved impracticable or administratively infeasible

Additional onsite soil removal, sediment and surface water monitoring, erosion control measures, and establishment of the Conservation Area were required by the Federal Natural Resource Trustees (National Oceanographic and Atmospheric Administration and Department of the Interior) ("Federal Trustees") as part of a consent decree ("Consent Decree") executed in 1995 by EPA, General Battery Corporation ("GBC"), and three Site owners.

EPA issued the first ESD in December 1996 to allow treatment of contaminated soil and battery casings at off-site facilities rather than at Exide's lead smelter.

EPA issued the second ESD in December 1997 to use the Pennsylvania Act 2 criterion of five milligrams per liter ("ug/l") as the clean-up standard for lead in groundwater, and the non-zero Maximum Contaminant Level Goals for the other constituents of concern.

In March 1998 EPA invoked the contingent remedy to solidify/stabilize the soil and battery casings, as provided for in the 1992 ROD, because the innovative treatment technology proved impracticable.

EPA modified the remedy further with a ROD Amendment in May 2000. The following changes were incorporated: the requirement for separation of lead posts and plates was limited; deed restrictions were eliminated for an adjacent residential property on which battery breaking did not occur; the requirement to clean up that residential property to 200 ppm of lead was added; the requirement for the fence to be constructed along the waterways was modified; the excavation sequence was modified to reduce the potential for releases during a flood event; the soil excavation in uncontaminated areas was limited; soils containing less than 1000 mg/kg of lead were allowed to be used for backfill onsite; and the treatment of soils that met the applicable Land Disposal Restrictions under the Resource Conservation and Recovery Act, as amended, was eliminated.

EPA further amended the 1992 ROD in July 2003, eliminating the requirements to install the vertical limestone barrier in the shallow alluvial aquifer and to pump-and-treat on-site contaminated groundwater from the bedrock aquifer. In lieu of the barrier and pump-and-treat technology, the July 2003 Amendment required the injection of in-situ treatment agent(s) directly into the alluvial and bedrock units. This decision was based on data collected during the remedial design phase which identified a very limited area requiring groundwater cleanup.

Finally, EPA modified the 1992 ROD in September 2003 by issuing the third ESD which required adding a two-foot soil cover to be placed on the railroad embankment; modifying site use restrictions; and extending these restrictions to include the railroad embankment.

The Cleanup Objectives consist of:

- (1) relocation of residents and the on-site business during the time of on-site construction (Operable Unit I),
- (2) removal of contamination from onsite soils, so that the Site can be used in an industrial manner (Operable Unit II), and
- (3) the groundwater remediation by increasing the pH in the shallow aquifer to between 6.0 and 8.0, and restoration of the groundwater to its beneficial use by cleaning both the shallow and deep aquifers to background levels (Operable Unit II),
- (4) implementation of the institutional controls.

All of the above objectives with the exception of achieving groundwater cleanup levels and implementation of institutional controls for the railroad embankment have been achieved.

## **Remedy Implementation**

### Removal Action 1984

EPA's Emergency Removal Program temporarily relocated three families residing on the Site in October 1983. Excavation of the contaminated soils and battery casings also by EPA began in January 1984 and continued until June 1984. Approximately 13,000 cubic yards of battery casings and contaminated soil were consolidated and capped in the southwest portion of the Site (known as the "Containment Area"). EPA completed this removal action in July 1984, and the residents thereafter returned to the Site. They were permanently relocated in 1990.

### Second Removal Action and First Operable Unit Remedial Action 1992 – 1990

EPA temporarily and then permanently relocated the site residents and onsite business.

### Second Operable Unit Remedial Action 2000 -2003

Between June 2000 and November 2002, Exide performed the following activities: excavation, treatment, and off-Site disposal of approximately 40,000 tons of soil and battery castings; excavation, treatment, and temporary on-Site staging of approximately 25,000 tons of contaminated soils and battery casings; stream bank enhancements; decontamination of buildings; demolition of a trailer; installation of erosion and sediment controls; and monitoring. Exide also constructed a fence and implemented institutional controls with three of the site owners.

On April 15 2002, Exide filed for Chapter 11 bankruptcy protection and indicated to EPA that it did not have the financial ability to complete the entire Remedial Action in accordance with the Consent Decree. Consequently, EPA continued the soil cleanup work left by Exide. The Agency completed the disposal of the 25,000 tons of stabilized material in October 2002, and treated and disposed off-site 43,000 more tons of soil and battery casings. The last part of work was completed by Exide, which backfilled, re-graded, and re-vegetated the areas disturbed during the excavation of soils.

### Remedial Action 2003 - present

Since May 2003, Exide has been again involved in the remediation process. The RP has been performing in-situ injections of chemical agents into the contaminated groundwater plume in accordance with the modification of the remedy by the 2003 ROD Amendment.

The remediation continues on a contaminated groundwater plume area, which includes a small section of the shallow alluvial aquifer (in the vicinity of MW-10 and MW-12), and the upper bedrock groundwater narrow corridor extending from the approximate location of the former battery breaking slab toward the Schuylkill River. The contaminated upper bedrock zone is generally from 20 to 40 ft below ground surface (b.g.s.); groundwater below that depth is below clean-up standards.

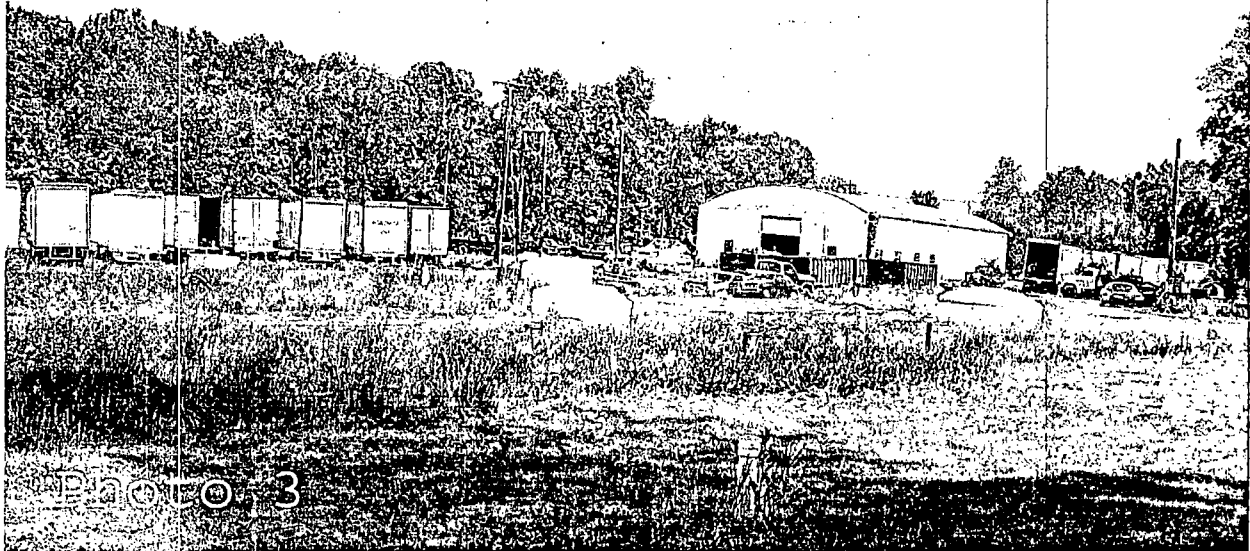


Photo 3: showing sodium bicarbonate injections area. Injection well identified by white stick-up, monitoring wells identified by grey stick-ups.

Groundwater monitoring conducted during last five years defines a limited groundwater plume that still exceeds in the Cleanup Standards (Figures 2 and 3). It is expected that within the next few years the above groundwater cleanup standards will be achieved throughout the plume.

### **System Operation and Maintenance**

The Consent Decree for the Site requires Exide to provide EPA monthly progress reports which include a short description of injection events, inspections, and sampling events taking place at the Site.

#### Injections

Passive injections of a sodium bicarbonate solution take place during the warm season on a monthly basis as weather allows. Tanks, storing sodium bicarbonate, and injection (white) and monitoring (gray) wells are presented on Photo 3. The injection process initially included 18 wells. In 2006, a new well was added to increase the efficiency of the treatment. During a typical injection, approximately 6,000 gallons of spring water and 3,000 pounds of  $\text{NaHCO}_3$  are combined to produce a mixture with a pH of approximately 8.2 and an alkalinity of 30,000 to 45,000 mg/l. This mixture is injected, typically, into ten wells per an injection event, and the entire injection usually takes four weeks. Between May 2003 and March 2007, there were 28 injection events and a total of 70,601 pounds of sodium bicarbonate was added to the groundwater within the target area.

#### Inspections

Exide also performed semi-annual general inspections which included evaluation of vegetation on the Conservation Area, inspection of river banks (rip rap condition, erosion control measures), and evaluation of trees and shrubs on the Conservation Area. As a result of the

general inspection damaged vegetation was repaired and two tree re-planting events took place in 2005 and 2006 at the Conservation Area.

### Sampling

Currently sampling is limited to groundwater monitoring, which includes water levels and metal concentrations. It is conducted quarterly. Exide collects samples from the wells within the contaminated plume area (i.e. MW-10, MW-12, MW-13, MW-16, and MW17) and from background wells (MW-8 and MW-15). Analyzed metals include cadmium, copper and lead for alluvial wells, and cadmium, copper, lead, beryllium, chromium and nickel for the bedrock wells. Quarterly reports included charts evaluating pH trends; they were used to select injection points and chemical agents being injected.

During the last five years, Exide properly fulfilled the above obligations.

## **V. Progress since the Last Review**

**Table 2: Actions Taken since the Last Five-Year Review**

<b>Issue</b>	<b>Recommendations/ Follow-up Actions</b>	<b>Party Responsible</b>	<b>Milestone Date</b>	<b>Action Taken and Outcome</b>
<i>First issue from 9/24/02 FYR:</i> EPA is currently performing a Removal Action to complete the soil cleanup	EPA completed the soil cleanup in August 2003, stabilizing and disposing an additional 43,000 tons of soil and battery casings.	EPA	February 2003 to August 2003	Soil cleanup was completed according to the design.
<i>Second issue from 9/24/02 FYR:</i> The RP has agreed to revegetate the Site in accordance with the Remedial Design.	The Conservation Easement/Mill Creek Corridor area was re- vegetated with 1,096 trees.  Additional 221 trees re- planted  Second re-planting event included 282 new trees	Exide	2003	Two years after the action an on-site inspection revealed that a survival rate was 40 percent.
		Exide	2005	In 2005, 499 dead trees were observed.
		Exide	2006	
<i>Third issue from 9/24/02 FYR:</i> The RP has agreed to complete the remediation of ground water.	The RP started in-situ injections of a sodium bicarbonate solution.	Exide	2003 till present	The plume area has diminished and metals concentrations generally lowered.

### Groundwater

The injection system has been in operation since the 9/24/02 five-year review. It included injections of a neutralization agent (sodium bicarbonate) into the network of wells. The process has been tuned-up by balancing the injection rates within the network of injection wells

and focusing on injections at specific points where changes were planned. This tune-up process is intended to ensure that the bulk of the alkalinity would be delivered to the areas of the highest acidity. The adjustments, specified in the RP's progress reports, included selection of wells, addition of one extra well (installed in 2006), and the quantity of sodium bicarbonate injected to each well. Historical pH measurements are presented in the Attachment 2, Figure 1. Based on this data, Ruth Associates, Inc., the RPs' contractor, prepared two maps presenting a spatial distribution of the plume. They are also provided in the Attachment 2 (Figures 1, 2, and 3).

The pH measurements collected at wells within the Target Area have remained fairly consistent over the past few monitoring events. The pH of groundwater sampled from alluvial wells fluctuates more than that of the bedrock wells.

The Target Area monitoring wells with groundwater concentrations still exceeding Cleanup Criteria during the July 2006 monitoring event were as follows:

*MW-10BR* – Exceeds Cleanup Criteria for beryllium, cadmium, lead and nickel.

*MW-12BR* – Exceeds Cleanup Criteria for beryllium, cadmium, lead and nickel.

*MW-13BR* – Exceeds Cleanup Criteria for nickel and lead. The nickel and lead concentrations have met or been slightly above the Cleanup Criteria since November 2003. No injections have been made in the area of this well since 2004.

#### Vegetation

Most of the originally planted trees and trees re-planted in 2005 died. The low survival rate might be attributed to specific topographical conditions forcing young trees to be exposed to long-lasting flooding from the Schuylkill River. Onsite soil and topographic conditions were such that the planted trees were not suited to it and could not adapt to the soils that were saturated much of the time due to both flooding of the Schuylkill River and precipitation. While the trees initially selected for planting were native to Pennsylvania and represented species typical of floodplain areas, they were not consistent with the species found in the floodplain areas in the vicinity of the site, particularly those species found in saturated soils. Consequently, most of the young trees died. In the Fall of 2006, following a Site inspection with EPA, PADEP, and U.S. Fish and Wildlife representatives, the RP re-planted the Site with different tree species. The new species, recommended by biologists, were introduced at the Site. The action was successful, because during the last Site inspection, performed on May 31, 2007, trees at 359 locations were determined to be surviving (Photo 4).



Photo 4 showing area replanted trees.

## **VI. Five-Year Review Process**

### **Administrative Components**

The Brown's Battery Five-Year Review Team was led by EPA Remedial Project Manager (RPM)), Romuald A. Roman, with assistance by EPA technical staff Hydrogeologist, Bruce Rundell; Toxicologist, Dawn Ioven; Biologist, Bruce Pluta; and Community Involvement Coordinator (CIC) Larry C. Johnson.

### **Community Involvement**

A notice announcing that EPA was conducting a five-year review for the Site was published in *The Hamburg Item*, a local newspaper, on August 15, 2007. Community interest in the site is considered to be low.

### **Document Review**

A complete list of documents reviewed can be found in Attachment 2. Documents reviewed in the process of conducting this five-year review included the last five-year review, two RODs, three ESDs, two ROD-Amendments, a Consent Decree, a Remedial Design, the past five years' worth of annual and semi-annual monitoring and operations reports, and the data collected over the past five years. The Applicable or Relevant and Appropriate Requirements (ARARs) listed in the 2000 ROD Amendment were also reviewed, and are presented here in the Attachment 4. In addition, several work plans and comments submitted regarding work plans were reviewed.

## **Data Review**

EPA has been reviewing monitoring and operations and maintenance data. These data include three types of reports: monthly progress reports from the RP, Exide Technologies; semi-annual inspection reports from the RP's contractor, Advanced GeoServices; and annual groundwater monitoring reports from the RP's contractor, Ruth Associates, Inc. All the monitoring and inspection reports are presented timely to EPA and discussed with the EPA RPM and relevant EPA scientists.

## **Site Inspection**

A site visit was conducted on May 23, 2007. The participants of the inspection team included: EPA RPM: Romuald A. Roman; EPA hydrogeologist; Bruce Rundell, PaDEP Project Manager; David M. Hrobuchak, and project manager representing the RP; Matt Love.

The participants started the inspection at the "log house" and the truck shop area. The inspectors met the property owner and one of his workers who were around the shop at the time of walk-through. The property owner inquired about the well providing water to his buildings, informed EPA that nobody drinks this water, and that nobody lives in the nearby brick building. The resident living in the "log house" was not at home at the time of inspection. EPA and PADEP asked the PRP to collect samples from the "log house" well (in the event there is a well inside the house) and from the well located near the "log house" (Photo 2). The PRP was given access to the well associated with the brick building, but not the "log house." The "shop well" was sampled and had all inorganics below MCLs.

The next part of the inspection included surrounding meadows. Grass growth was adequate. There were several trailers, cars, motorcycles, boats, dumpsters, and lawn tractors that extended more than half way into the former containment area. No erosion rills, gullies or battery casings were present.

At the center of the Site (containment area) grass growth was abundant. Vegetation was approximately 18 to 25 inches in high where no mowing has occurred. Where mowing has been performed, vegetation was approximately 4 to 6 inches. The west edge of the gravel road and east of the road to the tree line appear to be mowed regularly. There was no soil erosion.

On the Conservation Easement/Mill Creek Corridor grass was also abundant. No standing water and no signs of erosion were observed at the time of inspection. The majority of the new trees survived the winter and all participants of the inspection agreed that this time selection of species resulted in a high success rate.

Along the Schuylkill River, the bank stabilization was in good condition with no apparent signs of movement or undercutting. Rip rap was in place, stable, and without signs of sloughing. The biologs (rolls of coconut fiber used to stabilize the bottom of steep slopes) were in good

condition and covered with vegetation. Similarly, bank stabilization along the Mill Creek appeared to be in good condition.

The injection system was ready for the next event. Injection wells and tanks were in good condition. The entire area shows proper house keeping. There was no damage to the fences.

## Interviews

Community interest in the site is low. A township official, interviewed by the EPA CIC, stated that there have been no inquiries about the Site in several years and that his office has not received any complaints or comments about Site status or conditions. Additionally, no questions or concerns from the community have been fielded or received by the Site's CIC.

## VII. Technical Assessment

- *Question A: Is the remedy functioning as intended by the decision documents?*

Yes. The remedy is functioning as intended by the 1992 ROD, 2000 ROD Amendment, 2003 ROD Amendment, and the 1996, 1997, and 2003 ESDs. The major part of the Site was cleaned to industrial standards (1,000 mg/kg of lead), the log-house parcel was cleaned to residential standards (200 mg/kg of lead). The soils failing the landfill restrictions were treated prior to the off-site disposal. Clean fill and top soil were placed on excavation areas. It was followed by re-vegetation on the Conservation Area. Erosion control measures along the river banks are monitored and properly maintained. Vegetation on the Conservation area is monitored and trees and shrubs are re-planted as needed. The fence is maintained. In-situ injections of chemical agent(s) have lowered concentrations of lead and the groundwater plume has been shrinking. Therefore, the system is expected to ultimately achieve groundwater cleanup goals. However, until cleanup levels are achieved in groundwater, the two potable supply wells should be monitored to verify they remain unimpacted by the Site.

- *Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?*

The toxicity data are still valid. However, Cleanup Standards for groundwater contaminants which were initially listed in the 1992 ROD, Table 1 and 2, were modified several times. The 1997 ESD identified the Pennsylvania Act 2 criterion of five micrograms per liter (mg/L) as the cleanup standard for lead in groundwater, and Federal Maximum Contaminant Levels (MCLs) and non-zero Maximum Contaminant Level Goals (MCLGs) for other constituents of concern. Then, in the 2003 ROD Amendment, the cleanup levels for copper (1000 ug/l) and nickel (100 ug/l) were modified in accordance with Chapter 25 PA Code 250.

As a result of these modifications, the current Cleanup Standards for groundwater are as follows:

Alluvial Aquifer	Clean-up Standard	Bedrock Aquifer	Clean-up Standard
Cadmium	5 ug/L	Cadmium	5 ug/L
Copper	1000 ug/L	Chromium	100 ug/L
Lead	5 ug/L	Lead	5 ug/L
		Copper	1000 ug/L
		Nickel	100 ug/L
		Beryllium	4 ug/L

The Remedial Action Objective (RAO) of restoring ground water to the Cleanup Standards is expected to be met once cleanup is complete. The cleanup levels associated with this RAO are the Maximum Contaminant Levels (MCLs) and non-zero Maximum Contaminant Level Goals (MCLGs) specified in the Safe Drinking Water Act (SDWA). They have not changed for the contaminants at this Site.

- *Question C: Has any other information come to light that could call into question the protectiveness of the remedy?*

Yes. Institutional controls for the railroad embankment have yet to be implemented. These institutional controls would provide for worker safety, limit soil disturbance and prevent residential use of that portion of the site.

### Technical Assessment Summary

According to the data review the site inspection, and the interviews, the remedy is functioning as intended by the decision documents for the Site. There have been no changes in the physical conditions of the Site that would affect the protectiveness of the remedy. There have been no changes in the toxicity factors for the contaminants of concern that were used in the baseline risk assessment, and there have been no changes to the standardized risk assessment methodology that could affect the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.



## VIII. Issues

The table below summarizes the current issues at the Brown's battery Site.

**Table 3: Issues**

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
1. Verify historical conditions by monitoring "log house" and "shop well".	N	Y
2. Increase effectiveness of in-situ injections.	N	Y
3. Implement institutional controls for the railroad embankment.	N	Y

## IX. Recommendations and Follow-up Actions

**Table 4: Recommendations and Follow-up Actions**

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
1	Add sampling from "shop-well" and "log house"-well into the monitoring program	RP	EPA, PADEP	2007	N	Y
2	Increase effectiveness of in-situ injections.	RP	EPA, PADEP	May 2008	N	Y
3	Implement institutional controls for the railroad embankment	RP	EPA PADEP	2008	N	Y

## X. Protectiveness Statement

The remedy is considered protective of human health and the environment in the short term as the groundwater is treated. Except for the railroad embankment portion of the site, institutional controls are in place and there is no cause of potential exposure to Site groundwater.



In order for the Site to be considered fully protective in a long-term, groundwater cleanup levels must be achieved throughout the plume, and institutional controls must be implemented for the railroad embankment.

## **XI. Next: Review**

EPA will conduct another five-year review within five years of the completion of this five-year review report. The completion date is the date of the signature on the front of this report.



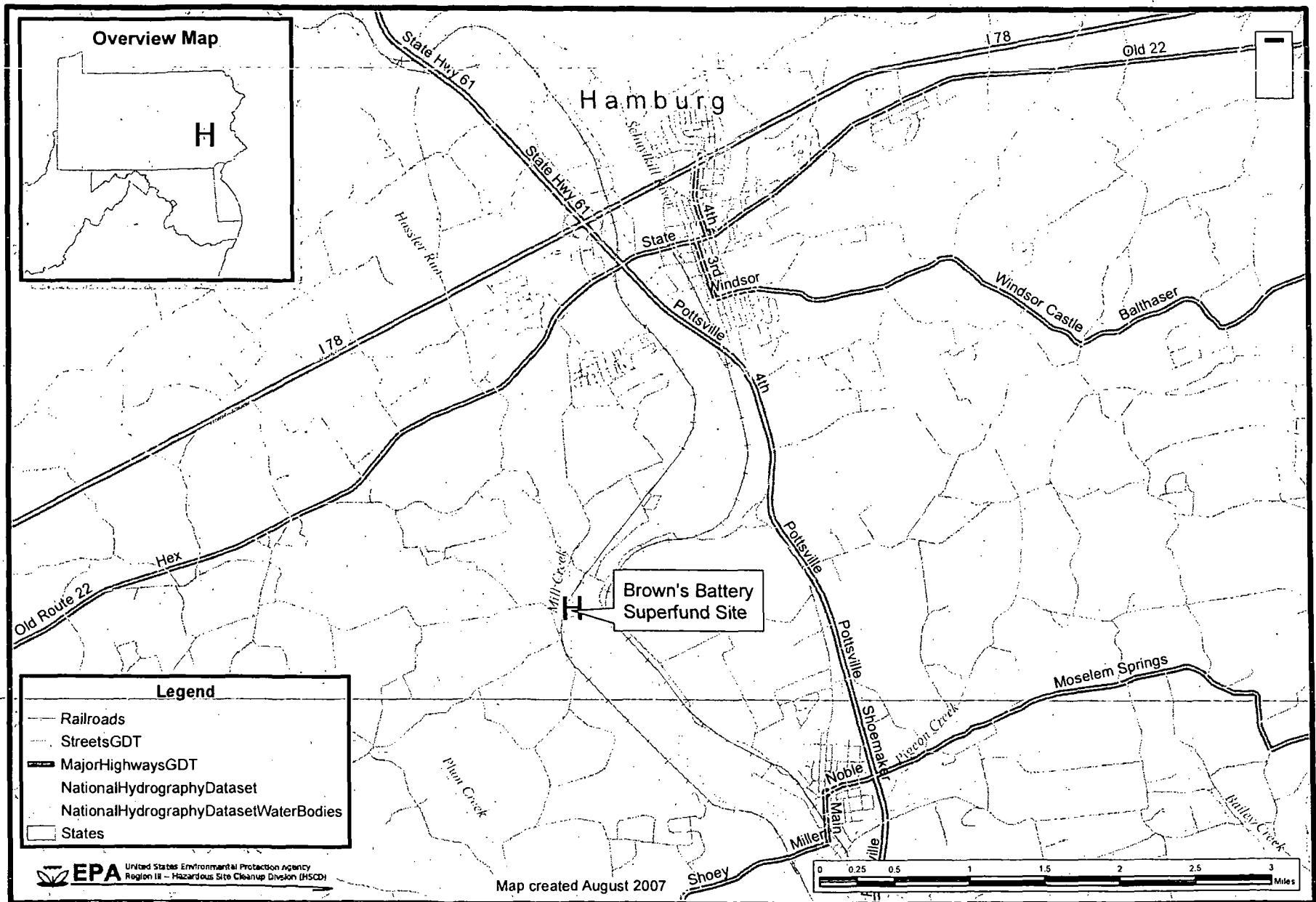
## **ATTACHMENTS**



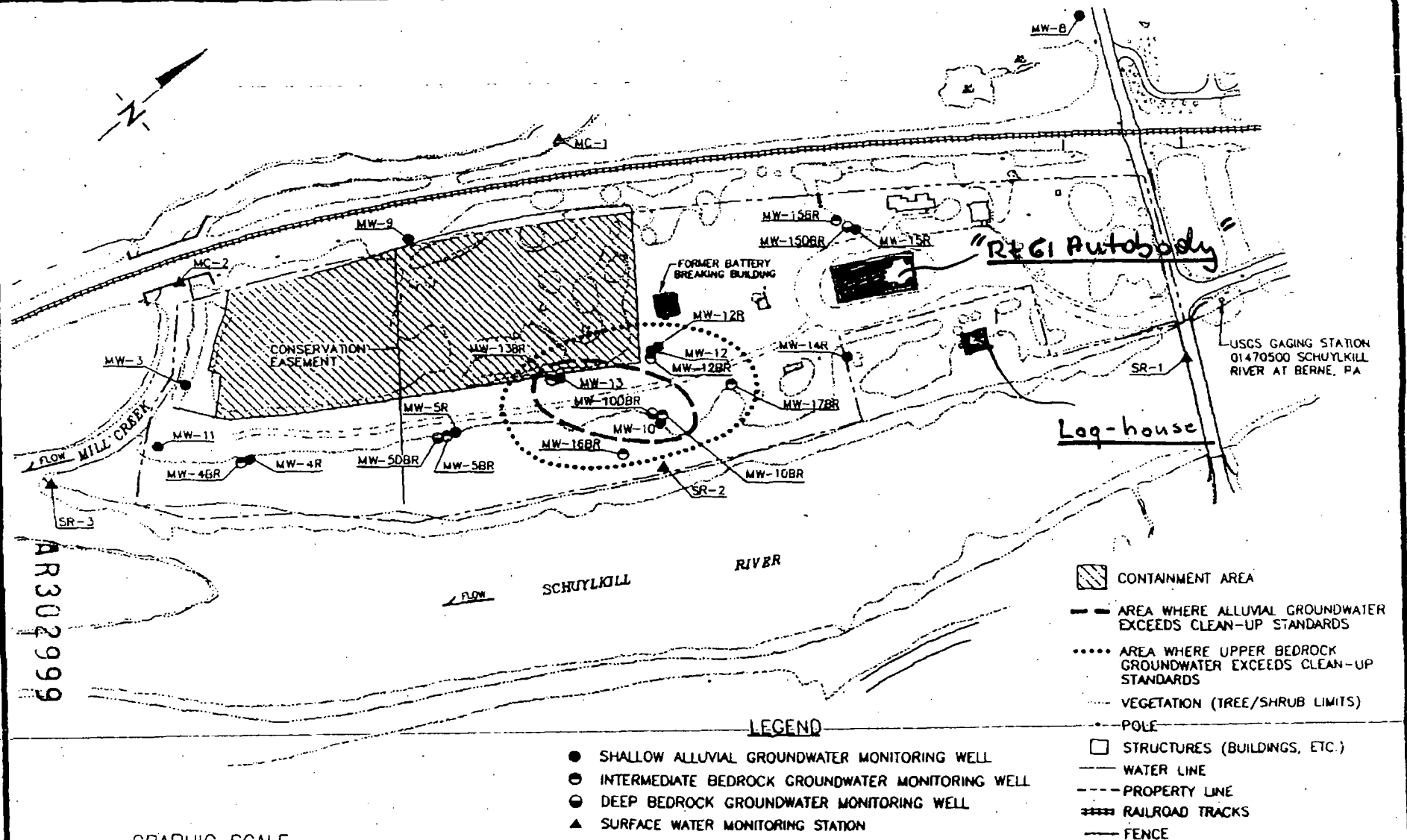
## **ATTACHMENT 1: Site Maps**



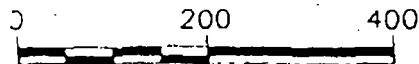
# Brown's Battery Breaking Site Location Map







GRAPHIC SCALE

**RUTH ASSOCIATES, INC**

2017 Chesapeake Road  
Annapolis, Maryland 21401

**AREAS WHERE ALLUVIAL AND UPPER BEDROCK  
GROUNDWATER EXCEEDS CLEAN-UP STANDARDS**

EXIDE CORPORATION  
BROWN'S BATTERY BREAKING SITE  
BERKS COUNTY, PENNSYLVANIA

FIGURE

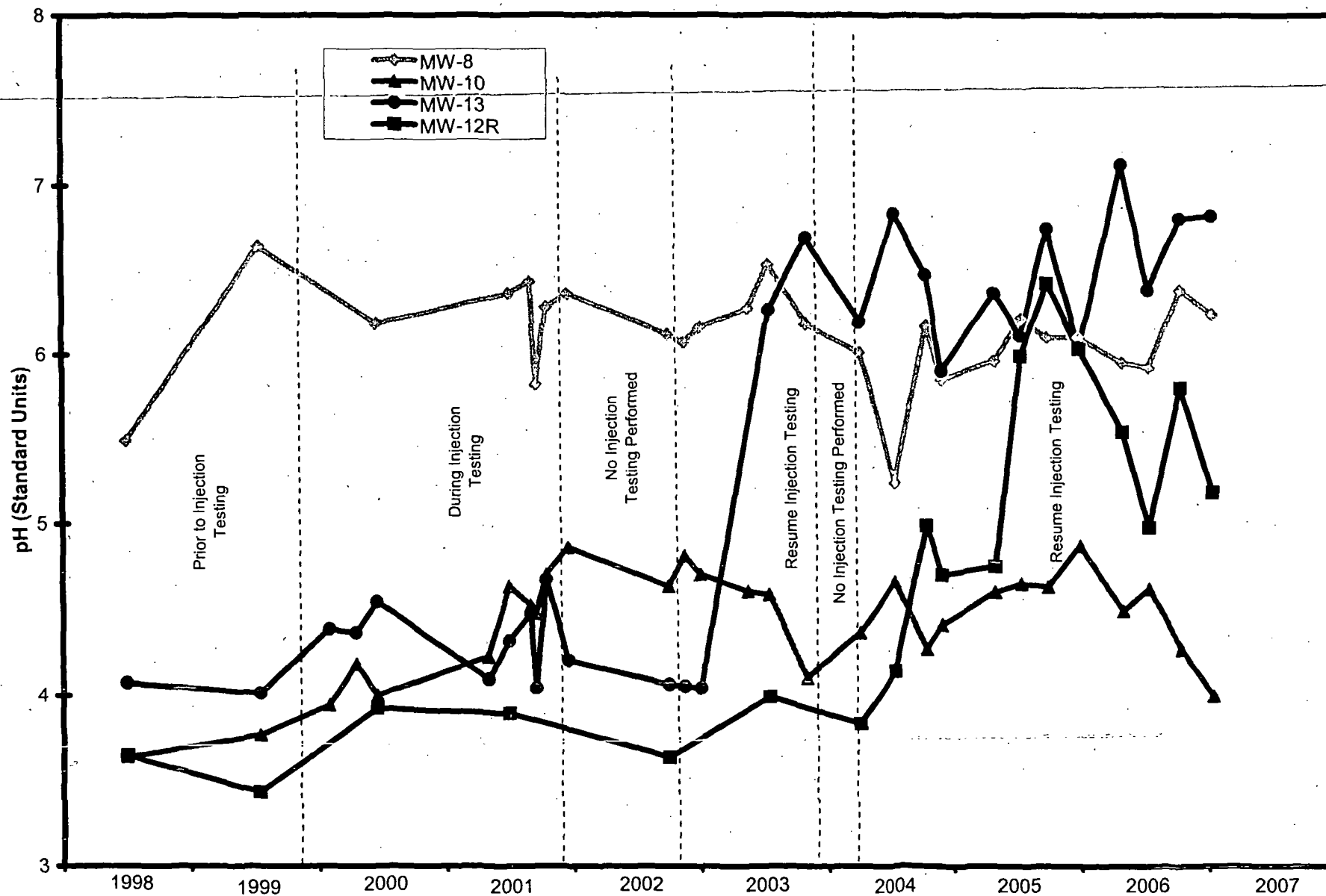
**2**

## **ATTACHMENT 3b: Groundwater Monitoring Parameters**

## **ATTACHMENT 2: Groundwater Cleanup Data**



**Figure 1**  
**pH Measurements vs. Time in Selected Alluvial Wells**  
**at the Brown's Battery Breaking Site**





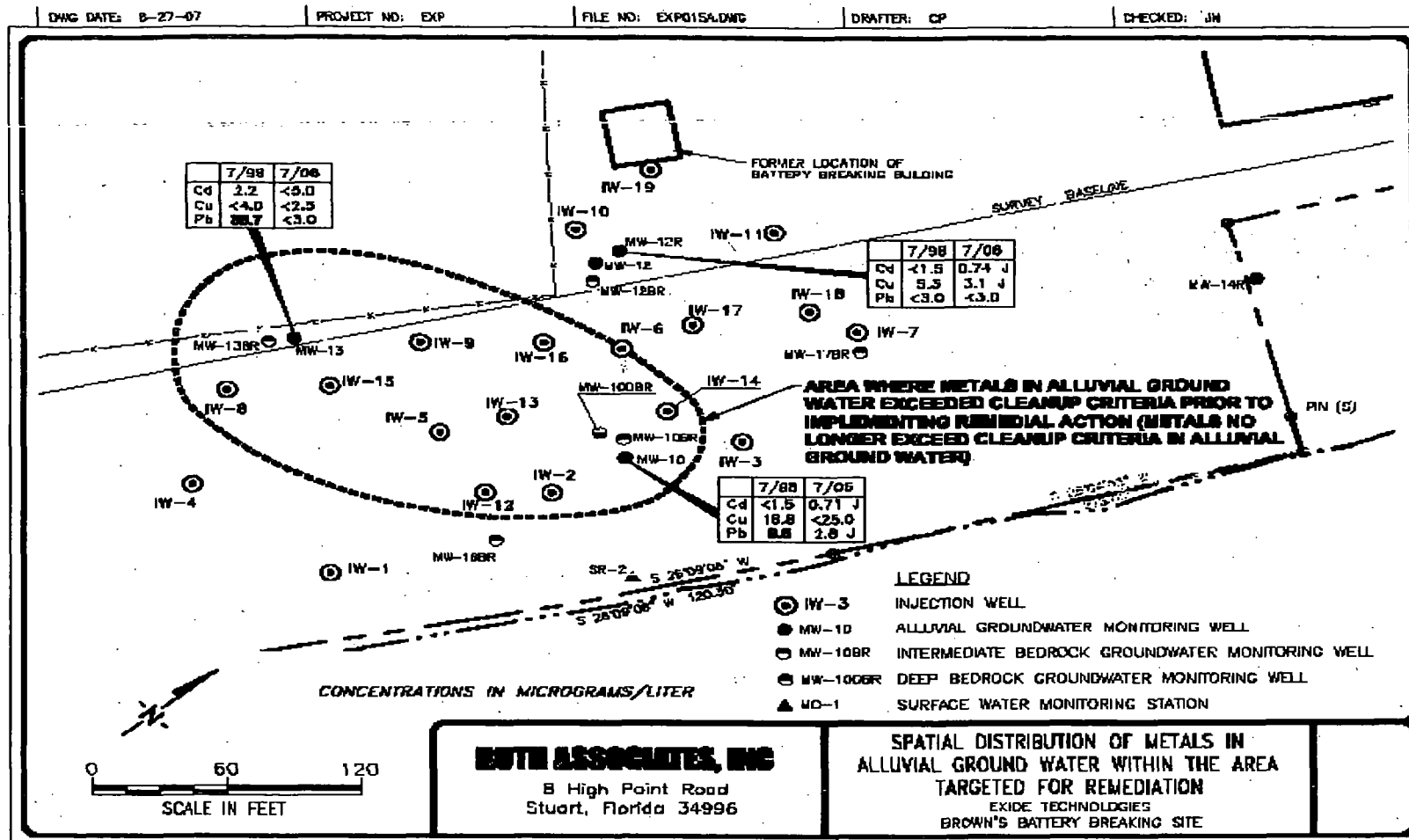


Figure 2



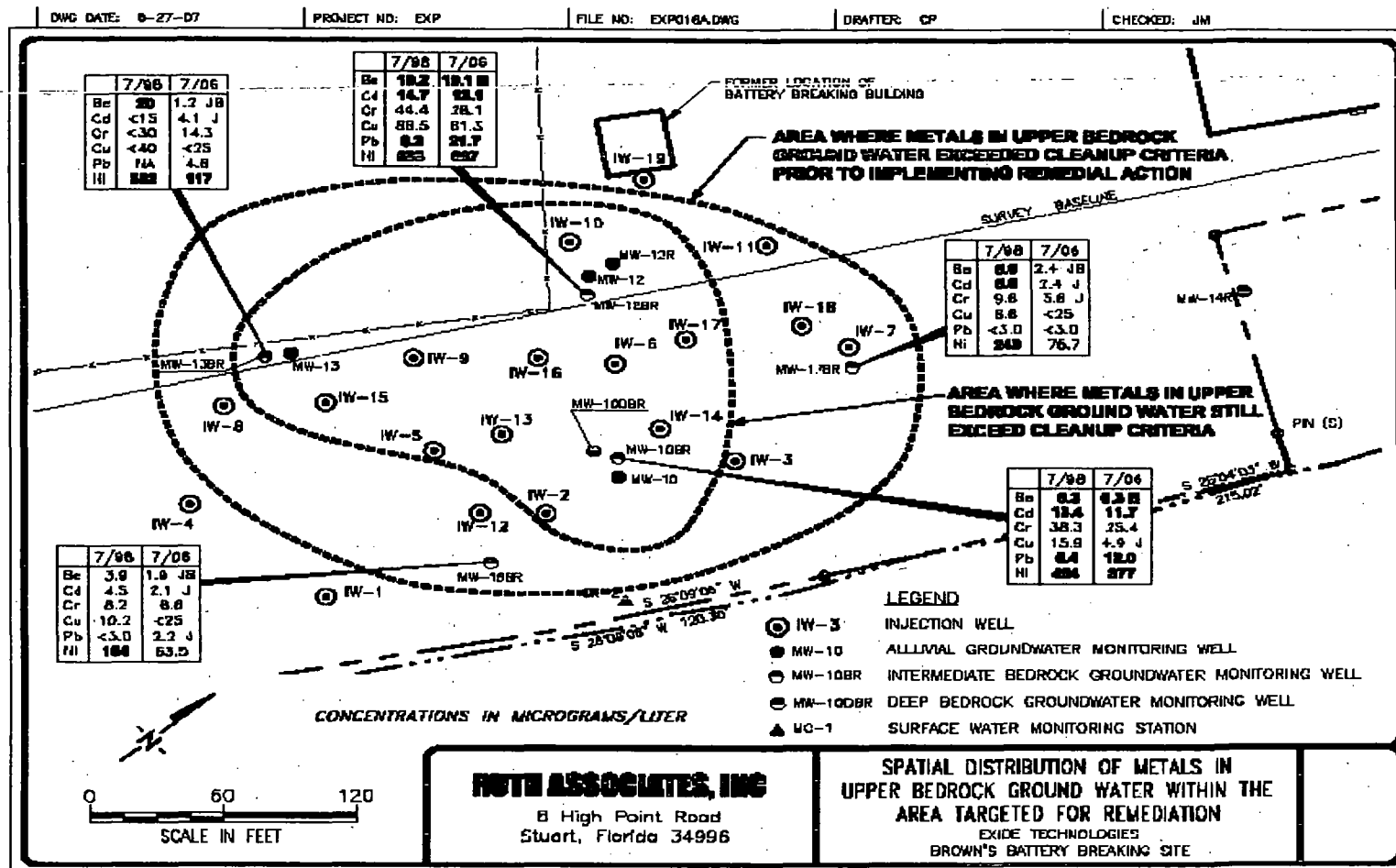


Figure 3

	7/98	7/06
Cd	2.2	<5.0
Cu	<4.0	<2.5
Pb	35.7	<3.0

FORMER LOCATION OF  
BATTERY BREAKING BUILDING

SURVEY BASELINE

	7/98	7/06
Cd	<1.5	0.74 J
Cu	5.3	3.1 J
Pb	<3.0	<3.0

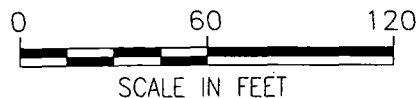
AREA WHERE METALS IN ALLUVIAL GROUND  
WATER EXCEEDED CLEANUP CRITERIA PRIOR TO  
IMPLEMENTING REMEDIAL ACTION (METALS NO  
LONGER EXCEED CLEANUP CRITERIA IN ALLUVIAL  
GROUND WATER)

	7/98	7/06
Cd	<1.5	0.71 J
Cu	18.8	<25.0
Pb	9.5	2.8 J

# LEGEND

- IW-3 INJECTION WELL
- MW-10 ALLUVIAL GROUNDWATER MONITORING WELL
- ⊖ MW-10BR INTERMEDIATE-BEDROCK-GROUNDWATER-MONITORING-WELL
- ⊙ MW-10DBR DEEP BEDROCK GROUNDWATER MONITORING WELL
- ▲ MC-1 SURFACE WATER MONITORING STATION

CONCENTRATIONS IN MICROGRAMS/LITER



**RUTH ASSOCIATES, INC**

8 High Point Road  
Stuart, Florida 34996

SPATIAL DISTRIBUTION OF METALS IN  
ALLUVIAL GROUND WATER WITHIN THE AREA  
TARGETED FOR REMEDIATION

EXIDE TECHNOLOGIES  
BROWN'S BATTERY BREAKING SITE



### **ATTACHMENT 3: ARARs**



## **Applicable or Relevant and Appropriate Requirements (ARARs)**

[From 1992 Record of Decision,  
2000 Record of Decision Amendment, and  
2003 Record of Decision Amendment)

### **ACTION-SPECIFIC ARARS**

#### **D) WATER**

*Clean Water Act's (33 USC Section 1251) (CWA) National Pollutant Discharge Elimination System Requirements* (enforceable for all discharges into surface water; 40 CFR Part 122).

Discharge standards are established to regulate the discharge into navigable waters in order to restore and maintain the chemical, physical, and biological integrity of the water. Discharge limitations will be established prior to the start of remedial actions and the discharge will be monitored to ensure compliance with the limitations.

Water Quality Standards (25 PA Code §§93.1 - 93.9).

The regulatory framework governing subsurface fluid distribution systems is established by the U.S. EPA Underground Injection Control ("UIC") Program. The regulations for the EPA UIC Program are set forth in 40 C.F.R. Part 144. The UIC regulations at 40 C.F.R. § 144.6 define and establish five classes of injection wells. Generally, Class V wells are shallow discharge or disposal wells, storm water or agricultural drainage systems, or other devices that are used to release fluids into or above an underground source of drinking water. In Pennsylvania, EPA Region HI has primacy in matters involving UIC and PADEP defers to EPA in implementing the UIC program. The following specific requirements are applicable to the injection of the in-situ treatment agent(s):

40 C.F.R. § 144.82 (a) *Prohibition of fluid movement* Injection activity cannot allow the movement of fluid containing any contaminant into an underground source of drinking water if it may cause a violation of the primary drinking water standards under 40 C.F.R. part 141, other health based standards, or otherwise adversely affect the health of persons. This prohibition applies to well construction, operation, maintenance, conversion, plugging, closure, or any other injection activity.

Remedial action will comply with the Pennsylvania Act 2 criterion of five milligrams per liter ("ug/l") as the clean-up standard for lead in groundwater, and the non-zero Maximum Contaminant Level Goals for the other constituents of concern. The remedial action will also comply with the cleanup levels for copper (1000 ug/l) and nickel (100 ug/l) in accordance with Chapter 25 PA Code 250.

25 PA Code Chapter 264, Subchapter F, regarding ground water monitoring. Contamination in



the ground water will be reduced to background levels as required by 25 PA Code §§264.90 - 264.100, specifically 25 PA Code §§264.97(i) and 64.100(a)(9). The exception to this is manganese, which will be reduced to the level specified by 25 PA Code §109.202 which is lower than the calculated background concentration. If implementation of the Selected Remedy 69 AR30I972 demonstrates, in corroboration with hydrogeological and chemical evidence, that it will not be possible to meet the remediation goals and it is thus technically impracticable to achieve and maintain background concentrations throughout either the shallow or bedrock aquifer (or for manganese in the bedrock aquifer, to achieve and maintain the State MCL) then EPA, in consultation with the Commonwealth of Pennsylvania, may amend the ROD or issue an Explanation of Significant Differences to inform the public of alternative ground water goals.

## **II. AIR**

The substantive requirements of the federally-approved State Implementation Plan for the Commonwealth of Pennsylvania, 25 Pa. Code §§ 123.1 -123.2; the *National Ambient Air Quality Standards for Particulate Matter* in 40 C.F.R. §§ 50.6 and 50.7; Pa. Code §§ 131.2 and 131.3 to control fugitive dust emissions generated during remedial activities.

## **III) HAZARDOUS WASTE**

The substantive provisions of the Land Disposal Restrictions of the Resource Conservation and Recovery Act, 40 C.F.R. § 268.48-49, to address treatment of lead-contaminated soil failing TCLP. The more stringent substantive provisions of either 25 Pa. Code §§ 262a, 264a (Subchapter L) or 25 Pa. Code §§ 75.262 and 75.264(t). The substantive requirements of Pennsylvania's Residual Waste Management regulations concerning analysis of waste, 25 Pa. Code § 287.54, and Pennsylvania's Residual Waste requirements, 35 P.S. § 6016.301-302.

Remedial action will comply with regulations for generation and transportation of hazardous wastes (49 CFR Parts 171 - 173 and 25 PA Code Chapter 262, Subchapters A and C, and Chapter 263).

Remedial action will comply with CERCLA §121(d)(3) which prohibits the disposal of Superfund Site waste at a facility not RCRA and all applicable State requirements.

Remedial action will not comply with State regulations for closure of hazardous waste sites (25 PA Code §265.300 - 310), but these closure regulations will be waived based on achieving an Equivalent Standard of Performance by the removal of the contaminated soils and remediation of the ground water to background levels.

## **IV) OSHA**

*Occupational Safety and Health Administration (OSHA) Requirements for Workers at Remedial Action Sites* (29 CFR Part 1910.120). The regulation specifies the type of safety equipment and procedures to be followed during site remediation. All appropriate safety equipment will be on-site and appropriate procedures will be followed during treatment activities.

## **CHEMICAL-SPECIFIC ARARS**

### **I) WATER**

*Safe Drinking Water Act (SDWA) AS AMENDED IN 1986* (42 USC S 300(F)). Maximum contaminant levels (MCLs) and non-zero maximum contaminant levels goals (MCLGs) contained in 40 CFR Part 141 and 143 provides standards for 30 toxic compounds, including 14 compounds adopted as RCRA MCLs, for public drinking systems. The MCLGs are non-enforceable health goals and are set at levels that would result in no known or anticipated adverse health effects with an adequate margin of safety. The MCL and non-zero MCLGs are used to determine the levels to which ground water should be remediated. During the predesign study EPA will determine which MCLs and non-zero MCLGs for volatile organic compounds and chromium must be met.

*SDWA Underground Injection Control Program (UIC)* (40 CFR Parts 144, 145, 146, 147). The UIC program regulates underground injections into five designated classes of wells. The construction, operation, or maintenance of an injection well must not result in the contamination of an underground source of drinking water at levels that violate MCLs or otherwise adversely affect the health of persons. The discharge from the infiltration gallery will meet the substantive requirements of the UIC program which will be determined in coordination with the state and federal UIC programs.

*Clean Water Act* (33 USC S 1251) *Federal Ambient Water Quality Criteria (AWQC)* (40 CFR Part 122). Contaminant levels regulated by AWQC are provided to protect human health from exposure to unsafe drinking water, from consuming aquatic organisms (primarily fish), and from fish consumption alone.

### **II. SOIL**

The soil cleanup standards are set forth in the OU-2 ROD and in the 2000 ROD Amendment. These levels range between 200 and 1000 parts per million.

PADEP has identified the groundwater cleanup standard for copper as 1000 ug/L (Maximum Contaminant Level) and for nickel as 100 ug/L (lifetime health advisory level). Both cleanup standards are the Medium Specific Concentration specified in the Act 2 Standards, 25 PA Code Chapter 250.304, Appendix A, Table 2.

## **LOCATION-SPECIFIC TO BE CONSIDERED**

### **I) WETLANDS AND FLOODPLAINS**

Plans for Site restoration will comply with recommendations outlined in the *Pennsylvania Scenic Rivers Act and Schuylkill River Scenic River Act* (No. 32 P.S. §§820.21, et seq. and 821.31 - 38).

Remedial action will comply with 40 CFR Part 6, Appendix A, and Executive Order 11988 regarding actions to avoid adverse impacts on floodplains.

### **II) WATER**

*Ground Water Protection Strategy of 1984* (EPA 440/6-84-002). Identifies ground water quality to be achieved during remedial actions based on aquifer characteristics and use. The EPA aquifer classification will be taken into consideration during design and implementation of the treatment remedy.

### **III) HAZARDOUS WASTE**

*EPA's "Management of Remediation Waste Under RCRA,"* EPA530-F-98-026, October 14, 1998, addressing Areas of Contamination in which contaminated soils are to be consolidated.

## **ATTACHMENT 4 : List of Reviewed Documents**



## List of Documents Reviewed

Brown's Battery Breaking Record of Decision. U.S. EPA Region III; July 2, 1992.

Brown's Battery Breaking Record of Decision Amendment. U.S. EPA Region III; May 31, 2000.

Brown's Battery Breaking Record of Decision Amendment. U.S. EPA Region III; July 30, 2003.

Brown's Battery Breaking Explanation of Significant Differences. U.S. EPA Region III; December 19, 1997.

Brown's Battery Breaking Explanation of Significant Differences. U.S. EPA Region III; December 19, 1997.

Advanced GeoServices Corp. Remedial Action Interim Completion Report Brown's battery Breaking Site, January 20, 2004

Exide Technologies, Progress Reports, Brown's Battery Breaker Superfund Site – December 5, 2003 to May 9, 2007

Ruth Associates, Inc, Results of the Groundwater Monitoring at the Brown's Battery Breaking - 2003 to 2007

Advanced GeoServices Corp. Inspection Reports Brown Batteries Breaking Site, 2003 to 2007